

Space Weather Technical Forecast

Issued on Friday, 13 May 2022 at 13:13 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: R1-R2 radio blackouts likely. Chance (30%) of G1 / Minor geomagnetic storm on day 4 (16th).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate with an M1.4 flare at 12/2020 UTC, which consisted of a long period flare from the northeast limb and a CME is apparent in coronagraph imagery. This is non-Earth directed. No other Earth-directed CMEs were observed in the available satellite imagery during the period. There are currently four numbered sunspots on the visible disc and two unnumbered regions, one to the northwest of AR3007, and the other recently appeared around the northeast limb. The largest and most complex region on the disc is AR3007 in the southeast quadrant. This region is a Beta-Gamma-Delta configuration, but has possibly shown some decay. AR3006 in the southwest has simplified to a Beta formation. AR3008 (Dai/Beta) has developed some intermediate spots over the past 6 hours, but still remains relatively simple. AR3010 continues to emerge, revealing a possibly more complex region, currently classified Dao/Beta. All other regions are small and simple and AR3009 has decayed to plage.

Solar Wind / Geomagnetic Activity: The solar wind speed as measured by DSCOVR at L1 has been ambient, generally between 300 and 380 km/s. The density started the period above average, with a peak of 35 ppcc at 12/1323 UTC, it has since declined, falling to average levels (5-10 ppcc) from 12/1850 UTC. The total interplanetary magnetic field strength was initially Moderate near 11nT, but for most of the period had been weak between 4 and 7 nT. The Bz fluctuated between positive and negative values, in the range -6/+8 nT. The Phi angle started the period negative (towards the Sun) until 12/1325 UTC when it switched to a predominantly positive (away from the Sun) orientation, indicating a sector boundary crossing, at 13/1000 UTC it rotated back into a negative orientation. Geomagnetic activity was Quiet to Unsettled (Kp 2-3).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) started the period at moderate levels, peaking at 2.22e0 ppcc at 12/1320 UTC. It has subsequently decreased, dropping to background levels from 12/2300 UTC. The high energy electron flux (greater than 2 MeV) has remained at background levels, with the corresponding electron fluence well below the Active (1e8 integrated pfu) threshold, with a slight decreasing trend. 1.1e6 integrated pfu observed at 13/0000 UTC.

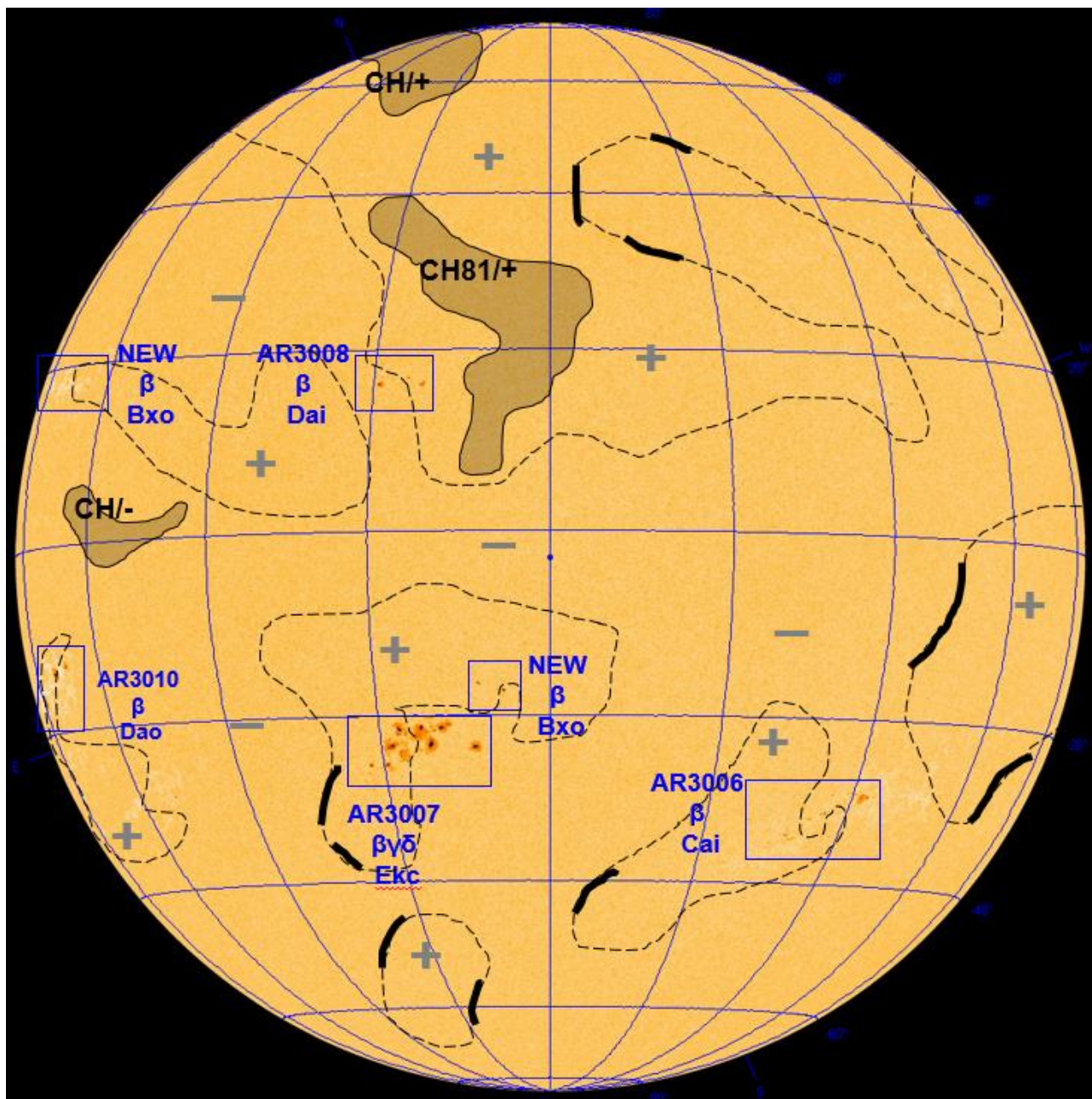
Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to remain Moderate (R1/R2) levels, with a slight chance of Strong (R3) X class flares.

Solar Wind / Geomagnetic Activity: No significant enhancements are likely in the solar wind in the next 3 days, however on day 4 (16th) winds are expected to become elevated due to the arrival of the High Speed Stream emanating from CH81/+. Predominantly Quiet geomagnetic activity is expected to become Unsettled to Active on day 4 (16th), with a chance of a G1 / Minor Storm.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to be at background levels during the forecast, although there is slight risk of an S1-S2 event due to the presence of AR3007. The high energy electron flux (greater than 2 MeV) is forecast to remain at normal background levels through much of the forecast period, with the 24-hour electron fluence staying below Active ($1e8$ integrated pfu) threshold.

Figure 1. Solar Analysis Valid 13/0700UTC.



Key: Filament ____, Prominence ____, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

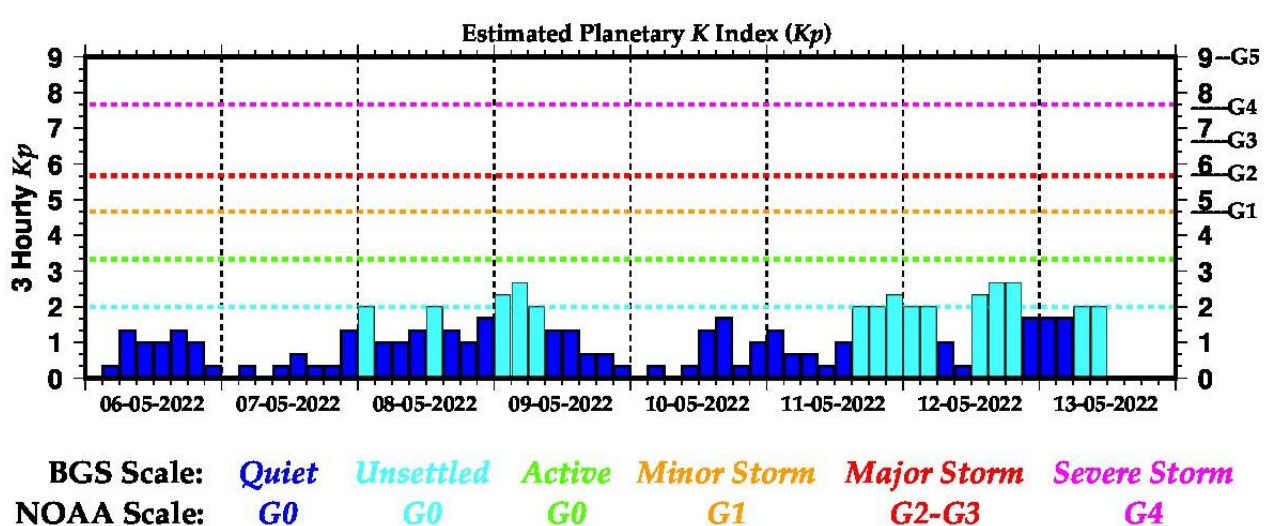
Geomagnetic Storms:

An X1.5 flare on 10 May from south-centre disc appears to have produced an asymmetric CME, combining with a long-period flare from the eastern limb. Coronagraph analysis remains inconclusive and although there is a chance of seeing a transient feature at L1 later on the 13th May, this remains unlikely, with no significant portion of this CME complex heading for Earth. Otherwise, solar winds are expected to remain at ambient levels through days 1-3 (13th-15th). On day 4 (16th), solar winds are expected to become elevated, as CH81/+ moves into a geoeffective position. Geomagnetic activity is expected to be predominantly Quiet during days 1-3 (13th-15th), with just isolated Unsettled intervals, in the absence of any CME influence. Activity becoming Unsettled to Active on day 4 (16th), with a chance of a G1 / Minor Storm, due to the arrival of the CIR and HSS associated with CH81/+.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	5	1	1	30
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections - Nil

Figure 2: BGS Kp index shows Quiet to Unsettled geomagnetic conditions.

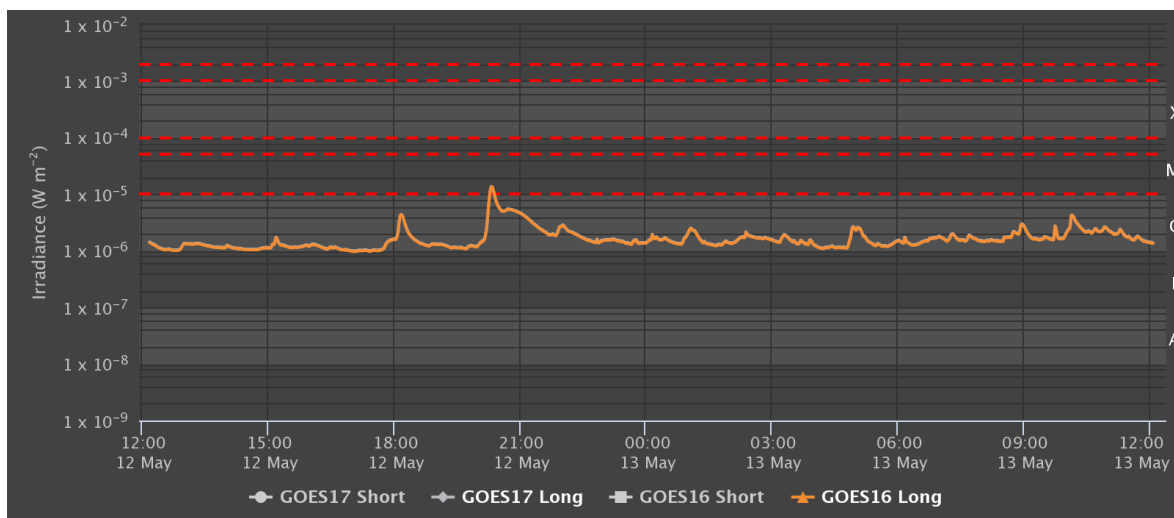


Radio Blackouts - X-Ray Flares:

Solar activity was Moderate over the past 24 hours. This level of activity is likely to continue, with further isolated M-class flares likely over the coming days and a slight chance of an X-class flare. Currently the most likely source for this activity is AR3007 (Ekc / Beta-Gamma-Delta). However, there are various bright regions visible on STEREO-A EUVI 195 imagery, which will be rotating onto the visible disc over the coming days and are likely to enhance the flare risk. One particularly bright region, just round the northeast limb, was responsible for the M1.4 flare at 12/2020 UTC.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	60	70	70	70
Very Active	R3 to R5 X Class	No	10	15	15	15

Figure 3: GOES16 X-ray flares shows one M class flare.



Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is close to background levels and is generally expected to remain at that level throughout the period. However, there is a slight chance of an S1-S2 event during the forecast period, primarily due to AR3007 which will continue its transit across the visible disc and into the western hemisphere over the coming days.

Radiation Storms	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq \text{S1}$	No	10	10	10	10
Very Active	$\geq \text{S3}$ *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $\text{cm}^{-2}\text{sr}^{-1}\text{s}^{-1}$)

High Energy Electrons Event ($\geq 2\text{MeV}$):

High energy electron flux (greater than 2 MeV) is expected to be at background levels through much of the forecast period, but may begin to rise towards the end of day 4 (16th) due to the arrival of the high speed stream from CH81/+. The corresponding electron fluence is therefore expected to remain below the Active ($1\text{e}8$ integrated pfu) threshold during the forecast period.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	No	1	1	1	5
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	1